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The Effect of Labour Demand on Regional Demographics

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The Effect of Labour Demand on Regional Demographics

by René Morissette, Social Analysis and Modelling Division

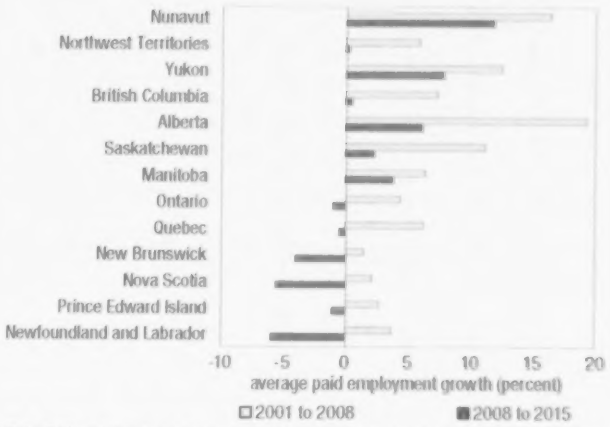
This article in the *Economic Insights* series assesses the degree to which changes in labour demand affect the working-age population and the regional demographic dependency ratio, based on a range of administrative data and Statistics Canada's population estimates. The results suggest that over periods of seven years, a 5.0% decline in regional labour demand reduces the regional population aged 15 to 64 by 4.5% to 6.0%. Because working-age individuals are leaving economically declining regions, a 5.0% decline in labour demand raises the demographic dependency ratio (the number of youth and seniors divided by the number of individuals aged 15 to 64) by between 1.1 and 1.5 percentage points, from a baseline rate of roughly 50.0%.

Introduction

When the demand for labour falls within a local region, what happens to the size of the working-age population and the demographic dependency ratio in that area? Simple models of labour supply and demand suggest that populations will decline as working-age individuals leave to find employment elsewhere, and that the demographic dependency ratio (the number of youth and seniors divided by the number of individuals aged 15 to 64) will rise. An increase in labour demand is expected to have the opposite effects—drawing in working-age individuals and their families. While this theory provides guidance on the expected direction of change, the magnitude of such a change is not well understood.[1] If regional labour demand decreases by, for example, 5.0%, how large a decline in the working-age population and how significant an increase in the demographic dependency ratio might be observed? The goal of this paper is to answer this question.

Using administrative data, the study quantifies demographic changes observed in 76 economic regions that were characterized by different trends in labour demand from 2001 to 2015. The study takes advantage of the substantial differences in employment growth across economic regions. For example, from 2001 to 2008, the 8 economic regions in Alberta experienced paid employment growth that averaged about 19.0%—more than three times the amount registered in the economic regions of Quebec and Ontario (Chart 1).[2] From 2008 to 2015, the 14 economic regions in Newfoundland and Labrador, Nova Scotia and New Brunswick saw paid employment decline by 4.0% or more, while the 24 economic regions in Manitoba, Saskatchewan and Alberta posted gains averaging 2.0% or more. The study uses this spatial variation in paid employment growth to measure the parameters of interest.

Chart 1
Average paid employment growth in economic regions, by province and territory, 2001 to 2008 and 2008 to 2015



Note: Paid employment growth is measured as the growth in the number of tax filers aged 15 to 64 who had some paid employment income in a given year.
Source: Statistics Canada, Canadian Employer–Employee Dynamics Database.

Employment growth might be driven not only by changes in regional labour demand, but also by changes in regional labour supply. For example, if worker preferences for amenities change in a way that shifts labour supply towards regions with high job vacancy rates, employment in these regions will increase for reasons unrelated to labour demand. The challenge is to extract changes in labour demand from the observed employment growth.

1. Using data at the census division level, Marchand (2012) assesses the degree to which the population of various age groups (15 to 24, 25 to 34, 35 to 44, and 45 to 64) grew faster in some areas with energy resources than in other areas during the oil booms and the oil bust experienced by Alberta from 1971 to 2006. However, Marchand (2012) does not quantify the degree to which changes in local labour demand affect the working-age population of regions or their demographic dependency ratio.
2. These numbers represent unweighted averages across economic regions. Paid employment growth is measured by the growth in the number of tax filers aged 15 to 64 who have some paid employment income in a given year.

To do so, this study uses variation in regional labour demand induced by national changes in the distribution of employment by industry. The underlying idea is simple: if, for example, factors external to a given region cause a decline in manufacturing employment nationwide, regions where employment was heavily concentrated in manufacturing at the beginning of the reference period should fare worse than other regions on various indicators. The regional employment growth that would have occurred if industries in a given region had grown at the same pace they grew nationally is used to extract information about regional changes in labour demand. Using this empirical strategy, the study quantifies the impact of changes in local labour demand on the size of the working-age population and the dependency ratio within economic regions (see the "Data and methods" section in the annex).[3] This informs discussions about labour mobility, population aging and the functioning of local labour markets.

Descriptive evidence

From 2001 to 2015, the population aged 15 to 64 grew at markedly different rates across economic regions. As a result of the oil boom of the 2000s, the number of individuals in this age group increased by 38.0% or more in the economic regions of Calgary, Edmonton, Red Deer and Wood Buffalo–Cold Lake (Table 1-2). In contrast, the population aged 15 to 64 fell by 10.0% or more in the following economic regions: South Coast–Burin Peninsula, West Coast–Northern Peninsula–Labrador, Notre Dame–Central Bonavista Bay, Cape Breton, Southern Nova Scotia, Campbellton–Miramichi, Edmunston–Woodstock, Gaspésie–Îles-de-la-Madeleine, Côte-Nord, Parklands, Cariboo, North Coast and Nechako (Tables 1-1 and 1-2).

The demographic dependency ratio also evolved differently, falling by about 2 to 10 percentage points in all economic regions in Saskatchewan but increasing in virtually all economic regions in Atlantic Canada, Quebec, and British Columbia.

Economic regions with strong growth in paid employment generally experienced higher-than-average population growth (Chart 2). For example, Wood Buffalo–Cold Lake saw its paid employment and its population aged 15 to 64 rise by about 38.0% and 49.0%, respectively, from 2001 to 2015 (Table 1-2), while about twenty economic regions experienced declines on both measures. Across all 76 economic regions, paid employment and the population aged 15 to 64 grew by 7.9% and 7.3%, respectively, on average.[4]

Since strong population growth is positively correlated with growth in paid employment (Chart 2) and negatively correlated with changes in the demographic dependency ratio (Chart 3), economic regions that had strong growth in paid employment experienced smaller increases (or larger declines) in their demographic dependency ratio (Chart 4).

While Charts 2 to 4 suggest that employment growth tends to increase the population and decrease the dependency ratio of a given region, they are subject to two limitations. First, these charts do not distinguish the degree to which employment growth at the regional level is driven by increases in labour demand, rather than increases in labour supply. Second, they display only bivariate relationships and thus do not control for other confounding factors. To overcome these limitations, multivariate analyses are required.

Multivariate analyses

The extent to which changes in labour demand affected the population aged 15 to 64 in regions from 2001 to 2015 is addressed in Table 2. Results are shown using ordinary least squares (OLS) and instrumental variable (IV) estimators. Unlike the OLS, the IV methods do not confound the effects of labour demand and labour supply when measuring the impact of changes in labour demand on socio-economic outcomes.[5] For this reason, the preferred multivariate analyses and the ensuing discussion are based on IV methods.

Two sets of regressions are considered regardless of the estimator. In the first set, changes in the logarithmic value of the population aged 15 to 64, measured over two seven-year periods (2001 to 2008 and 2008 to 2015), are regressed on a binary indicator for the 2008-to-2015 period and on changes in the logarithmic value of regional paid employment (as measured by the number of employees aged 15 to 64, estimated from the Canadian Employer–Employee Dynamics Database). Province indicators are added in the second set of regressions.[6,7]

Whether province indicators are included or not, the elasticity of the population aged 15 to 64 with respect to labour demand—based on the IV estimator—varies between 0.9 and 1.2. This suggests that, on average, a 5.0% drop in regional labour demand reduces the population aged 15 to 64 by between 4.5% (5.0% times 0.9) and 6.0% in a given region over a seven-year period.

3. Bound and Holzer (2000) used a similar approach to quantify the effect of labour demand on socio-economic indicators in central metropolitan areas in the United States during the 1980s.
4. These numbers are unweighted averages across regions.
5. This statement holds under two conditions. First, the instrumental variable used must be strongly correlated with the endogenous explanatory variable (i.e., paid employment growth). The first-stage F statistic, shown in Table 2, indicates that this condition is satisfied. Second, the instrumental variable used must be uncorrelated with the error term in the outcome equation (i.e., regional changes in the population aged 15 to 64).
6. Province indicators capture factors other than labour demand that affect population size. For example, changes in provincial income tax rates may induce interprovincial migration, affecting the size of regional populations in the provinces that are undergoing changes in tax rates.
7. In addition, two different instrumental variables are used with the IV estimator. The results are reported in Table 2 under "Model 1" and "Model 2." See the "Data and methods" section for details.

Table 1-1
Selected socio-economic indicators, by economic region, 2001 and 2015 — Newfoundland and Labrador to Ontario

	Population aged 15 to 64			Demographic dependency ratio			Growth in paid employment
	2001	2015	Growth	2001	2015	Change	
	counts		percentage change	percent		percentage points	percentage change
Newfoundland and Labrador							
Avalon Peninsula	176,242	192,564	9.3	40.4	44.2	3.9	15.6
South Coast–Burin Peninsula	31,853	23,671	-25.7	39.5	53.4	13.9	-14.3
West Coast–Northern Peninsula–Labrador	79,395	70,359	-11.4	41.7	50.4	8.7	-4.9
Notre Dame–Central Bonavista Bay	81,690	69,515	-14.9	44.1	56.5	12.4	-6.2
Prince Edward Island	91,415	96,576	5.6	49.5	51.9	2.4	1.6
Nova Scotia							
Cape Breton	100,820	83,988	-16.7	50.0	57.9	7.9	-10.6
North Shore	108,361	98,248	-9.3	49.9	56.7	6.8	-7.2
Annapolis Valley	83,436	81,009	-2.9	49.1	53.9	4.8	2.0
Southern	83,704	72,049	-13.9	49.5	58.5	9.0	-9.1
Halifax	262,818	296,466	12.8	40.5	41.0	0.4	7.1
New Brunswick							
Campbellton–Miramichi	122,486	99,541	-18.7	43.1	54.4	11.3	-12.3
Moncton–Richibucto	131,222	142,420	8.5	43.3	48.7	5.4	7.8
Saint John–St. Stephen	116,726	113,656	-2.6	47.9	50.5	2.7	-1.3
Fredericton–Oromocto	88,961	94,968	6.8	43.4	47.4	4.0	3.0
Edmundston–Woodstock	58,856	50,692	-13.9	46.5	53.2	6.7	-9.8
Quebec							
Gaspésie–Îles-de-la-Madeleine	67,432	59,016	-12.5	46.2	56.5	10.2	-5.2
Bas-Saint-Laurent	139,817	127,051	-9.1	46.1	57.5	11.4	-1.2
Capitale-Nationale	460,690	487,351	5.8	41.4	50.4	9.0	10.0
Chaudière-Appalaches	270,939	273,968	1.1	44.3	54.2	10.0	6.1
Estrie	199,061	208,432	4.7	46.4	54.2	7.8	2.9
Centre-du-Québec	152,163	155,916	2.5	46.4	55.4	9.0	7.6
Montérégie	912,916	1,012,919	11.0	43.9	50.3	6.5	11.4
Montréal	1,280,726	1,374,565	7.3	44.5	44.8	0.3	2.6
Laval	240,391	284,037	18.2	45.7	49.8	4.1	14.9
Lanaudière	274,333	334,032	21.8	44.5	49.0	4.5	22.2
Laurentides	326,931	400,807	22.6	44.7	48.2	3.6	20.2
Outaouais	227,469	264,958	16.5	42.0	45.4	3.4	11.6
Abitibi-Témiscamingue	102,538	98,808	-3.6	44.9	49.8	4.9	6.7
Mauricie	177,646	171,627	-3.4	46.4	56.0	9.6	-0.6
Saguenay–Lac-Saint-Jean	199,030	181,707	-8.7	42.3	52.8	10.5	-2.1
Côte-Nord	70,931	62,941	-11.3	40.3	49.0	8.8	-10.0
Nord-du-Québec	26,007	29,460	13.3	51.2	52.0	0.7	1.9
Ontario							
Ottawa	804,056	907,330	12.8	45.2	46.7	1.6	8.2
Kingston–Pembroke	293,707	307,847	4.8	50.5	52.7	2.2	2.8
Muskoka–Kawarthas	227,646	241,741	6.2	55.7	58.5	2.7	2.1
Toronto	3,588,880	4,480,826	24.9	43.8	43.5	-0.3	20.1
Kitchener–Waterloo–Barrie	740,125	893,520	20.7	48.3	47.1	-1.2	17.2
Hamilton–Niagara Peninsula	871,968	968,324	11.1	50.5	50.5	0.0	2.9
London	409,426	450,685	10.1	49.0	49.1	0.1	5.4
Windsor–Sarnia	424,900	419,948	-1.2	49.3	52.3	3.0	-4.4
Stratford–Bruce Peninsula	191,821	188,883	-1.5	55.1	59.6	4.6	-2.3
Northeast	386,300	367,240	-4.9	48.7	52.6	3.9	-2.9
Northwest	164,865	158,008	-4.2	49.5	51.2	1.7	-11.4

Note: The demographic dependency ratio is the number of individuals under 15 or over 64 divided by the population aged 15 to 64, and expressed as a percentage. The growth in paid employment is measured as the percentage change in the number of tax filers aged 15 to 64 with paid employment income.

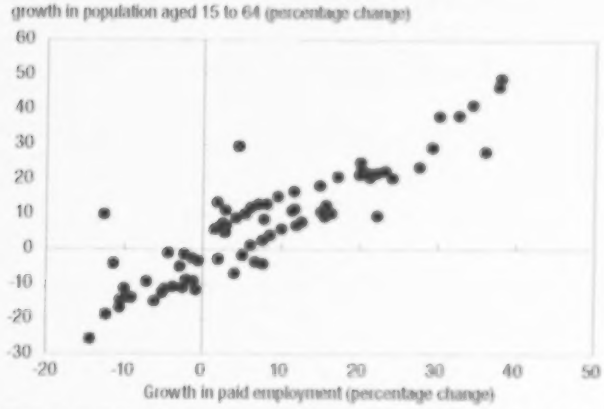
Sources: Statistics Canada, Canadian Employer–Employee Dynamics Database and population estimates from the Demography Division.

Table 1-2
Selected socio-economic indicators, by economic region, 2001 and 2015 — Manitoba to Nunavut

	Population aged 15 to 64			Demographic dependency ratio			Growth in paid employment
	2001	2015	Growth	2001	2015	Change	
	counts		percentage change	percent		percentage points	percentage change
Manitoba							
Southeast	57,942	74,080	27.9	53.7	55.2	1.5	36.0
South Central	32,987	40,741	23.5	62.6	60.8	-1.8	27.6
Southwest	66,856	73,701	10.2	58.3	55.0	-3.3	16.4
North Central	30,639	31,878	4.0	59.2	59.5	0.3	8.6
Winnipeg	431,647	496,516	15.0	48.1	45.7	-2.4	9.6
Interlake	55,718	60,665	8.9	52.2	53.3	1.1	4.2
Parklands	27,222	24,284	-10.8	66.9	68.2	1.4	-3.8
North	53,142	58,407	9.9	59.6	59.8	0.2	-12.6
Saskatchewan							
Regina–Moose Mountain	183,520	221,157	20.5	50.8	47.3	-3.5	21.3
Swift Current–Moose Jaw	66,402	65,206	-1.8	60.1	57.5	-2.6	5.1
Saskatoon–Biggar	194,490	251,137	29.1	49.9	44.7	-5.3	29.2
Yorkton–Melville	54,062	51,784	-4.2	67.4	64.7	-2.8	7.7
Prince Albert	125,534	135,296	7.8	61.1	59.1	-1.9	12.6
Northern	19,403	25,112	29.4	69.2	58.9	-10.3	4.5
Alberta							
Lethbridge–Medicine Hat	160,279	194,412	21.3	52.9	53.3	0.4	20.0
Camrose–Drumheller	119,535	134,485	12.5	56.3	54.5	-1.8	15.7
Calgary	749,758	1,098,808	46.6	39.9	40.1	0.1	37.7
Banff–Jasper–Rocky Mountain House	58,477	65,177	11.5	41.0	42.1	1.1	11.7
Red Deer	106,430	147,164	38.3	47.7	45.4	-2.3	32.6
Edmonton	700,861	990,270	41.3	43.0	41.4	-1.6	34.4
Athabasca–Grande Prairie–Peace River	151,519	185,388	22.4	50.6	49.0	-1.6	23.2
Wood Buffalo–Cold Lake	73,660	109,653	48.9	45.3	38.4	-6.9	37.9
British Columbia							
Vancouver Island and Coast	479,848	512,319	6.8	49.5	55.1	5.6	11.9
Lower Mainland–Southwest	1,678,206	2,018,449	20.3	42.0	42.8	0.8	24.2
Thompson–Okanagan	316,733	346,922	9.5	53.1	56.7	3.6	22.3
Kootenay	102,100	94,993	-7.0	48.0	56.8	8.7	4.1
Cariboo	118,527	105,475	-11.0	41.2	48.5	7.3	-2.5
North Coast	45,480	38,849	-14.6	44.3	47.7	3.5	-10.5
Nechako	29,591	26,147	-11.6	46.2	51.0	4.8	-0.9
Northeast	43,865	48,548	10.7	44.5	43.8	-0.7	15.1
Yukon	22,176	26,988	21.7	36.0	38.6	2.6	21.2
Northwest Territories	28,332	31,704	11.9	44.2	39.6	-4.6	6.2
Nunavut	17,262	23,842	38.1	63.0	53.2	-9.8	30.1

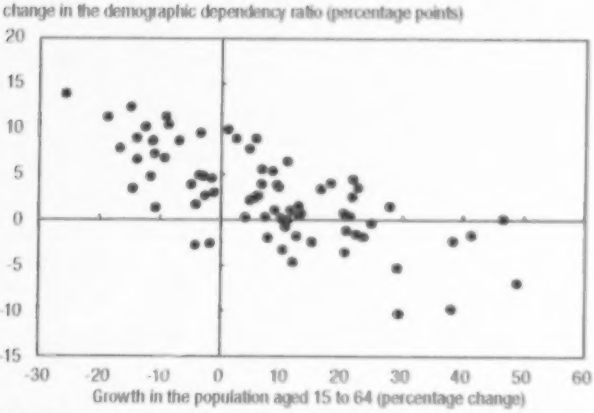
Note: The demographic dependency ratio is the number of individuals under 15 or over 64 divided by the population aged 15 to 64, and expressed as a percentage. The growth in paid employment is measured as the percentage change in the number of tax filers aged 15 to 64 with paid employment income.
Sources: Statistics Canada, Canadian Employer–Employee Dynamics Database and population estimates from the Demography Division.

Chart 2
Growth in paid employment and in the population aged 15 to 64, by economic region, 2001 to 2015



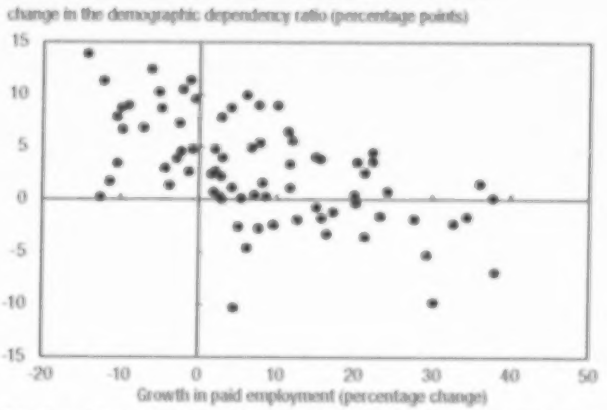
Note: The growth in paid employment is measured as the percentage change in the number of tax filers aged 15 to 64 with paid employment income. The figures for the growth in paid employment and in the population aged 15 to 64, by economic region, are shown in Table 1.
Sources: Statistics Canada, Canadian Employer–Employee Dynamics Database and population estimates from the Demography Division.

Chart 3
Growth in the population aged 15 to 64 and change in the demographic dependency ratio, by economic region, 2001 to 2015



Note: The figures for the change in the demographic dependency ratio and for the growth in the population aged 15 to 64, by economic region, are shown in Table 1.
Source: Statistics Canada, population estimates from the Demography Division.

Chart 4
Growth in paid employment and change in the demographic dependency ratio, by economic region, 2001 to 2015



Note: The growth in paid employment is measured as the percentage change in the number of tax filers aged 15 to 64 with paid employment income. The figures for the growth in paid employment and the change in the demographic dependency ratio, by economic region, are shown in Table 1.
Sources: Statistics Canada, Canadian Employer–Employee Dynamics Database and population estimates from the Demography Division.

Since younger workers tend to be more mobile than older workers, they would be expected to leave economically declining regions or migrate to expanding regions at a faster pace than older workers. Table 2 confirms this hypothesis. It shows that for individuals under 35, the elasticity of population with respect to changes in labour demand varies between 1.4 and 1.5. The corresponding elasticity for individuals aged 35 to 64 varies between 0.3 and 1.0. Thus, while a 5.0% decline in labour demand tends to reduce the regional youth population by between 7.0% and 7.5%, the same decline in labour demand will reduce the population of older workers by between 1.5% and 5.0%.[8]

Declines in regional labour demand reduce the working-age population, suggesting that such declines will also increase the regional demographic dependency ratio.

8. Differences in the magnitude of elasticities between younger and older individuals are statistically significant at the 5% level.

Table 2
Elasticity of regional population with respect to labour demand

	Ordinary least squares	Instrumental variables	
		Model 1	Model 2
	parameter estimates		
Elasticity of			
Population aged 15 to 64			
Not controlling for province of residence	0.97***	1.17***	1.16***
Controlling for province of residence	0.78***	0.90***	0.87***
Population aged 15 to 34			
Not controlling for province of residence	1.19***	1.41***	1.40***
Controlling for province of residence	0.96***	1.53***	1.53***
Population aged 35 to 64			
Not controlling for province of residence	0.82***	0.95***	0.94***
Controlling for province of residence	0.63***	0.37*	0.30
	number		
First-stage F statistic			
Not controlling for province of residence	...	37.8	31.6
Controlling for province of residence	...	23.9	18.0
Number of observations	152	152	152

... not applicable

* significantly different from reference category ($p < 0.05$)

*** significantly different from reference category ($p < 0.001$)

Note: Each cell shows the elasticity of population with respect to regional labour demand. Standard errors are clustered at the economic region level. The sample consists of 76 economic regions observed over two seven-year periods: 2001 to 2008 and 2008 to 2015. Changes in the logarithmic value of population are regressed on a binary indicator for the 2008-to-2015 period and changes in log paid employment. Province indicators are included in some regressions. When using instrumental variable methods, two versions of predicted paid employment growth are used as instrumental variables for changes in log paid employment. Model 1 includes the employment growth of a given industry in the region considered when computing nationwide employment growth in that industry. Model 2 excludes the employment growth of a given industry in the region considered when computing nationwide employment growth in that industry. Changes in the logarithmic value of the population are standardized for the age and sex composition of the population.

Sources: Statistics Canada, Canadian Employer–Employee Dynamics Database and population estimates from the Demography Division.

Table 3
Changes in regional demographic dependency ratios and labour demand

	Ordinary least squares	Instrumental variables	
		Model 1	Model 2
	parameter estimates		
Population under 15 and over 64 divided by the population 15 to 64			
Not controlling for province of residence	-0.11***	-0.28***	-0.29***
Controlling for province of residence	-0.11***	-0.22***	-0.24***
Population over 64 divided by the population 15 to 64			
Not controlling for province of residence	-0.11***	-0.19**	-0.20**
Controlling for province of residence	-0.08***	-0.13***	-0.14***
Population under 15 divided by the population 15 to 64			
Not controlling for province of residence	-0.01	-0.09*	-0.09*
Controlling for province of residence	-0.03*	-0.09**	-0.10*
	number		
First-stage F statistic			
Not controlling for province of residence	...	25.3	21.5
Controlling for province of residence	...	29.8	24.0
Number of observations	152	152	152

... not applicable

* significantly different from reference category ($p < 0.05$)

** significantly different from reference category ($p < 0.01$)

*** significantly different from reference category ($p < 0.001$)

Note: The sample consists of 76 economic regions observed over two seven-year periods: 2001 to 2008 and 2008 to 2015. Changes in demographic dependency ratios are regressed on a binary indicator for the 2008-to-2015 period, the share of the population aged 8 to 14 at the beginning of the seven-year period, the share of the population aged 58 to 64 at the beginning of the seven-year period, and changes in log paid employment. Province indicators are included in some models. When using instrumental variable methods, two versions of predicted paid employment growth are used as instrumental variables for changes in log paid employment. Model 1 includes the employment growth of a given industry in the region considered when computing nationwide employment growth in that industry. Model 2 excludes the employment growth of a given industry in the region considered when computing nationwide employment growth in that industry.

Sources: Statistics Canada, Canadian Employer–Employee Dynamics Database and population estimates from the Demography Division.

Table 3 confirms this hypothesis. Results from IV methods indicate that a 5.0% drop in regional labour demand will increase the demographic dependency ratio by between 1.1 percentage points (i.e., 5.0% times -0.22) and 1.5 percentage points (i.e., 5.0% times -0.29) from a baseline rate of 49.0% in 2001.[9,10] A 5.0% increase in regional labour demand is expected to decrease the demographic dependency ratio by the same amount. Table 3 also shows that most of the change in the demographic dependency ratio comes from changes in the ratio of the number of individuals over 64 years of age divided by the population aged 15 to 64, rather than from changes in the ratio of the number of children divided by the population aged 15 to 64.

Conclusion

Although declines in regional labour demand are expected to reduce the working-age population and increase the dependency ratio in a given region, the magnitude of these effects had not yet been estimated in Canada.

Using administrative data and Statistics Canada's population estimates, this study fills that gap. It shows that, over periods of seven years, a 5.0% decline in regional labour demand reduced the regional population aged 15 to 64 by 4.5% to 6.0%. Because working-age individuals are leaving economically declining regions, a 5.0% decline in labour demand raises the demographic dependency ratio by between 1.1 and 1.5 percentage points, from a baseline rate of roughly 50.0%.[11] Conversely, increases in labour demand—such as those witnessed in many economic regions of Alberta and Saskatchewan during the 2000s—tend to increase the working-age population and decrease the demographic dependency ratio.

In a context where population aging will pose a number of challenges, these results highlight the key role that employment growth may play to alter the demographics of regions.

Annex: Data and methods

This study combines data from the Canadian Employer–Employee Dynamics Database (CEEDD) and population estimates from the Demography Division to produce the estimates shown in Tables 1 to 3. The three following data sets from CEEDD are used: the T1 personal master file (T1PMF), the T4 Statement of Remuneration Paid (T4) and the Longitudinal Employment Analysis Program (LEAP). The 100% versions of T1PMF and T4 are used.

This paper examines changes in the working-age population and demographic dependency ratios across 76 economic regions (including Yukon, the Northwest Territories and Nunavut) over two periods of seven years (2001 to 2008 and 2008 to 2015).[12]

Population estimates and demographic dependency ratios are obtained from the Demography Division of Statistics Canada. Three demographic dependency ratios are used. The first ratio is the number of individuals under 15 or over 64 years of age divided by the number of individuals aged 15 to 64. The second is the number of individuals over 64 divided by the number of individuals aged 15 to 64. The third is the number of individuals under 15 divided by the number of individuals aged 15 to 64.

To assess the impact of labour demand on population size, a two-step procedure is used. First, changes in the logarithmic value of log population size are constructed for 20 age–sex cells for each of the 76 economic regions.[13] Denoting age groups, sex and regions by a, s and r, respectively, these changes (ΔY_{asr}) are regressed on a full set of age–sex interactions (θ_{as}), as well as on a vector of regional fixed effects (θ_r):

$$\Delta Y_{asr} = \theta_{as} + \theta_r + \varepsilon_{asr}. \quad (1)$$

Equation (1) is estimated separately for each of the seven-year periods defined above.[14] The parameter estimates for θ_r measure changes in log population size that are standardized for regional differences in the composition of the population by age and sex. In a second step, these parameter estimates are used to form the dependent variable in the following equation:

$$\hat{\theta}_{rt} = \alpha_p + \alpha_t + \beta \Delta \ln E_{rt} + u_{rt}; t = 2001-2008,\ 2008-2015, \quad (2)$$

where α_p is a vector of province and territory indicators,[15] α_t is a binary indicator for the period from 2008 to 2015 (2001 to 2008 is omitted), and $\Delta \ln E_{rt}$ measures changes in regional log paid employment.[16] Since there are 76 economic regions and two seven-year periods, Equation (2) is initially estimated using the ordinary least squares (OLS) estimator on 152 observations. The parameter β measures the elasticity of population size with respect to regional labour demand.

9. The 49.0% figure is an unweighted average of region-specific dependency ratios in 2001.
10. Changes in the demographic dependency ratio (in percentage points), measured over two seven-year periods (2001 to 2008 and 2008 to 2015) are regressed on a binary indicator for the period from 2008 to 2015, the share of the population aged 8 to 14 at the beginning of the seven-year period considered, the share of the population aged 58 to 64 at the beginning of the seven-year period considered, and changes in log paid employment. Province indicators are added in the second set of regressions.
11. There might be a floor below which the population of a given region would no longer fall after sustained decreases in labour demand. Hence, extrapolating these results beyond the typical regional employment growth rates observed during the observation period should be done with caution.
12. Results are similar when attention is restricted to the 73 economic regions of the 10 provinces.
13. The age groups used are 15 to 19, 20 to 24, 25 to 29, 30 to 34, 35 to 39, 40 to 44, 45 to 49, 50 to 54, 55 to 59, and 60 to 64.
14. When Equation (1) is estimated for the population aged 15 to 64, it contains 1,520 observations. When it is estimated for the populations aged 15 to 34 and 35 to 64, it contains 608 and 912 observations, respectively.
15. In the first set of models considered, these indicators are omitted.
16. Paid employment is drawn from the T4 files and captures the number of individuals who had some income from paid employment during a given year.

To account for the possibility that $\Delta \ln E_{rt}$ might be correlated with the error term u_{rt}, Equation (2) is also estimated using the instrumental variable (IV) estimator. When doing so, variable $IV1_{rt}$ is used as an instrumental variable for $\Delta \ln E_{rt}$:

$$IV1_{rt} = \sum_i Share_{ir0} * \Delta \ln E_{it}; t = 2001-2008, 2008-2015. \quad (3)$$

where $\Delta \ln E_{it}$ measures employment growth in industry i nationwide during the seven-year period t ($t = 2001-2008, 2008-2015$) and $Share_{ir0}$ measures the share of industry i in total paid employment of region r at the beginning of the seven-year observation period that is considered. $IV1_{rt}$ measures the predicted growth in paid employment that would occur in region r if each industry had grown at the same pace regionally as it had grown nationally.[17] A second instrumental variable, $IV2_{rt}$, is also used. When $IV2_{rt}$ is used, employment growth in industry i nationwide excludes employment growth in that industry in the economic region r that is being considered.

In Tables 2 and 3, columns "Model 1" and "Model 2" report instrumental variable results based on $IV1_{rt}$ and $IV2_{rt}$, respectively.

To analyze regional changes (measured in percentage points) in various demographic dependency ratios, ΔDR_{rt}, the following equation is estimated with the OLS estimator and the IV estimator:

$$\Delta DR_{rt} = \theta_p + \theta_t + \lambda SHARE_08_14_{r0} + \eta SHARE_58_64_{r0} + \beta \Delta \ln E_{rt} + v_{rt}; t = 2001-2008, 2008-2015. \quad (4)$$

where $SHARE_08_14_{r0}$ ($SHARE_58_64_{r0}$) equals the share of the population in region r aged 8 to 14 or 58 to 64 at the beginning of a seven-year period, θ_p is a vector of province and territory indicators, and θ_t is a binary indicator for the period from 2008 to 2015.

Because economic regions are the unit of analysis in this study and because sampling variability issues do not arise when using the 100% versions of T1PMF and T4, Equations (1) to (4) are unweighted (i.e., estimated without population weights). In all cases, standard errors are clustered by economic region.

17. Information on the main job held by workers (obtained from T4 files) is combined with their industry of employment (obtained from LEAP). A total of 102 three-digit industries from the 2012 North American Industry Classification System (NAICS) are considered. These industries are used in Equation (3) to compute $IV1_{rt}$ and $IV2_{rt}$ for each of the 76 economic regions considered in this study.

References

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